Marketing Research Report No. 953

The Freight Car Supply Problem and Car Rental Policies

ECONOMIC RESEARCH SERVICE / U.S. DEPARTMENT OF AGRICULTURE

ABSTRACT

Pricing policies are discussed as they relate to the supply and allocation of freight cars for the movement of agricultural products. Incentives guiding the allocation of empty cars--per diem, time-and-mileage car rentals, car service orders, and demurrage--have not always been adequate to ensure an equitable distribution of cars. The incentive per diem plan instituted in 1970 by the Interstate Commerce Commission is intended to increase freight car utilization by speeding up the return of general purpose boxcars during the grain harvest season when the shortage is most severe. Despite improved pricing policies, demand for freight cars will probably continue to exceed supply for several years. However, growing use of other modes of transportation for hauling agricultural products, improved railroad operations, and addition of more specialized equipment should reduce the demand for general purpose boxcars.

Keywords: Transportation, freight car, pricing, policy, per diem, car service orders.

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Use of the name of a particular company in this report does not constitute endorsement of the company named or imply discrimination against other companies.

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SUMMARY

Recent changes in the per diem system--the pricing mechanism whereby one railroad is compensated for the use of its cars by another--are not sufficient to overcome the inadequate supply of freight cars for the movement of agricultural products. Although these changes may be helpful in effecting a more equitable distribution of cars and in changing the level of railcar utilization, other factors--charges to shippers, seasonality of shipments, and competition from other modes of transportation--determine the total demand for cars. Since demand may exceed supply at times, car service orders specifically directing the movement of cars and other legal measures will probably be required for several years during periods of shortages.

Under the incentive per diem plan instituted by the Interstate Commerce Commission in 1970, railroads must pay an additional daily rental charge for general purpose boxcars during September-February. The extra charge is intended to speed up the return of cars to their owners during the grain harvest season, the period of heaviest demand.

Numerous factors affect the availability of freight cars--number of cars owned by railroads, shippers, and car companies; amount and type of freight hauled; and level and seasonality of railcar utilization. (Standardization of rail gage permits cars to move freely from one road to another.) Incentives guiding the allocation of empty cars--per diem, car service orders, and demurrage--have not always been adequate to ensure an equitable distribution of these cars.

A comparison of freight originations with terminations from 1955 to 1967 indicates that regional imbalances have tended to increase. In the Western District, historically the area with the greatest shortage of empty cars, demand for general purpose boxcars or cars that can be used in their place--special service boxcars or covered hopper cars--continued to exceed supply.

Over the years railroads have improved overall efficiency by reducing the time cars are unserviceable and by increasing car capacity, average load per car, total car capacity, train speed, and amount of centralized traffic control. Since 82 percent of total car-days are spent in railroad operations and only 18 percent in loading and unloading, even modest improvements in car utilization by railroads have considerable impact on cars available for service.

Generally, car rental rates have not been high enough to compensate for ownership costs. The low rate of return has probably discouraged railroads from purchasing railcars, especially high-cost equipment, and may have contributed to the poor distribution of freight cars by encouraging railroads to hold cars rather than return them empty.

Railcar owners are required to use the additonal revenue obtained under the new incentive per diem orders to purchase more general purpose boxcars. Between 1955 and 1967, general purpose boxcars owned by Class I railroads declined from 661,194 to 429,482, or 35 percent. In comparison, ownership of special service boxcars increased 137 percent and covered hopper cars, 179 percent.

Despite improved pricing policies, the shortage of general purpose boxcars will probably persist for some time. Competition from other modes of transportation may help to reduce the demand for freight cars. In 1968, barges moved almost 12 million tons of feed grains, compared with about 4 million tons in 1961. More efficient operations by the railroads and the addition of more specialized equipment should also help reduce the demand for general purpose boxcars.

THE FREIGHT CAR SUPPLY PROBLEM AND CAR RENTAL POLICIES

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INTRODUCTION

Agriculture in the United States depends on long-haul transportation to move much of its production to processors, retailers, and export points. Development over the years of a vast network of railroads, highways, and waterways has enabled the agricultural regions of the Nation to concentrate on the commodities they produce most efficiently. This specialization not only has created a great need in certain regions for specific types of railcars, but it has given rise to periods of peak demand due to seasonality of production and marketing.

Railroads were instrumental in developing many of the areas specializing in agriculture; they are still prime movers of some products from these areas. Although competing modes--trucks and barges--are taking over an increasing share of that movement, railroads continue to transport large volumes of certain commodities, especially grain.

For years, rail shippers have complained that the supply of freight cars is inadequate for their needs. Grain and lumber producers have been especially vocal in demanding more cars. Newspaper headlines of grain stored on the ground in the Great Plains and Northwest awaiting transportation, testimony before congressional committees, and complaints of widely scattered shippers, railroads, and Government agencies--all point to the inadequacy of the railcar fleet. In a letter to the Interstate Commerce Commission (ICC) on December 11, 1969, the chairman of the Senate Commerce Committee stated: ". . . Congress has been deluged with reports from shippers on freight car shortages . . . ." (18, p. 64)[1/] The long-term nature of the problem is apparent from the report of Franklin K. Lane to the National Association of Railway Commissioners in 1908: "Extreme car shortages in 1906 and 1907 resulted in 25 States enacting car service laws and 20 States . . . reciprocal demurrage agreements." (15)

This report analyzes the freight car supply problem and discusses pricing policies and other factors related to the continuing shortage--trends in numbers and types of cars utilized, distribution of ownership between railroads and shippers, volume of freight hauled, and changes in incentives to move empty cars.

1/ Underlined numbers in parentheses refer to Literature Cited, p. 27.

FREIGHT CAR OWNERSHIP

Numerous factors affect the ownership of freight cars--interchange of some equipment among lines, differing needs of the products moved and the areas served, and the high costs of acquiring and maintaining railroad equipment. When a freight car moves from one railroad to another with a load, efficiency dictates that the receiving line use the car productively, if feasible, rather than return it empty. Standardization of track gage about 1886 and the adoption of a standard automatic coupler 2 years later made this interchange of cars possible (16, p. 93).

Raw materials and manufactured goods--the two basic types of railroad freight--have different transportation requirements. Raw materials are usually more bulky relative to their value than finished goods and are produced throughout the country. Most manufacturing, on the other hand, is concentrated in a few metropolitan areas. Consequently, sparsely populated rural areas require more transportation equipment for the farm products they market than for the finished goods they purchase. Thus, a railroad moving raw materials from a rural area may have to bring in empty cars to satisfy shippers' needs, while a road shipping manufactured goods from an urban area may have a number of empty cars at its disposal. To fill the diverse requirements of shippers and achieve the maximum rate of return from their investment, some roads may find it more profitable to utilize cars belonging to other lines rather than purchase their own.

Cars Owned by Class I Railroads

The chief owners of railcars are the Nation's Class I railroads. 2/ In 1929, when ownership of cars was at an alltime high, these railroads owned approximately 2.3 million railcars with a total carrying capacity of 105.4 million tons. By 1955, car numbers had declined to 1.7 million and carrying capacity had dropped to 91.2 million tons. The fleet continued to diminish in the next decade and by 1967, it totaled 1.5 million cars. Carrying capacity, meanwhile, rose to 93.7 million tons. (See fig. 1.)

Even more significant than the drop in car numbers and slight increase in carrying capacity is the change in composition of the car fleet from 1955 to 1967 (table 1). General purpose boxcars (the principal type used in grain gathering) declined 35 percent. Special service boxcars and covered hopper cars, also used to transport certain agricultural raw materials 3/ and manufactured goods, increased about 137 percent and 177 percent, respectively. Although their numbers declined from about 760,000 to 685,000, aggregate capacity of all three types of cars rose from 37.7 million tons to 40.9 million tons during the period (tables 2 and 3).

2/ Railroad operating companies are classified for statistical purposes on the basis of average operating revenues for a 3-year period. Since 1965, the following classification has been in effect: Class I, revenues of $5 million or more; Class II, revenues under $5 million (12).

3/ For example, grain may be hauled in general service boxcars or covered hopper car; lumber is carried in general service boxcars or special service boxcars.

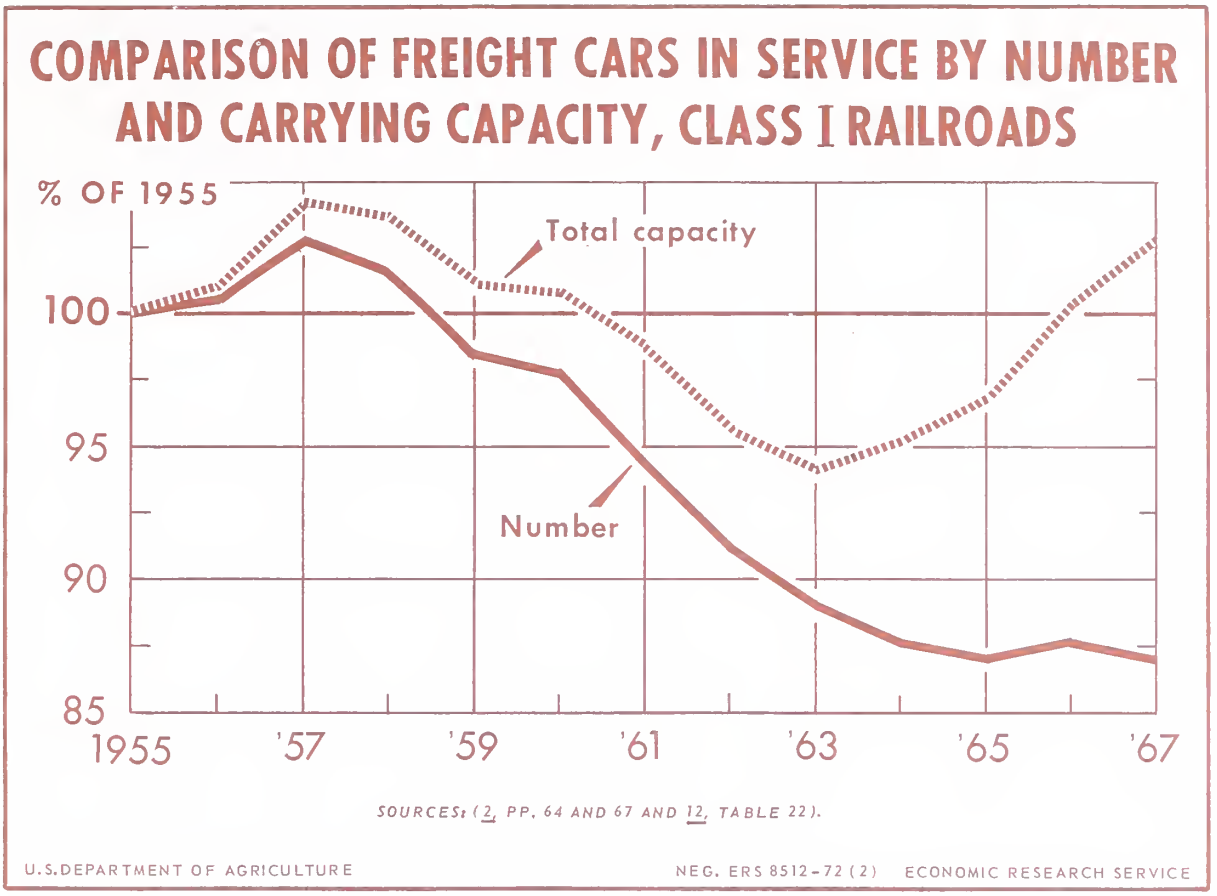

Figure 1

How freight cars are allocated among the three principal operating districts defined by the ICC (see fig. 2) is important in analyzing the supply problem. From 1955 to 1967, the Eastern District had a substantial decline in cars and carrying capacity; the Southern District, a slight increase in cars and a large increase in carrying capacity; and the Western District, about the same number of cars but a substantial increase in carrying capacity.

Cars Owned by Nonrailroad Companies

Some of the freight cars comprising the Nation's fleet belong to car companies and individual shippers. In 1967, 97.2 percent of all tank cars and 55.5 percent of all refrigerated cars were owned by private car lines. 4/ Such cars are generally more expensive than general purpose cars and their use may be strictly controlled by a lessee. While private ownership makes specialized equipment more accessible to shippers, it may result in more empty movements than when cars are owned by railroads.

4/ Private companies owning most of the refrigerated cars were holding companies owned jointly by several of the Class I railroads.

Table 1.--Number and classification of railroad cars owned by Class I railroads, 1955 and 1967

Car class	1955		1967		
	Cars	Percentage of total	Cars	Percentage of total	Percentage of 1955
	Number	Percent	Number	Percent	Percent
Box:					
General purpose	661,194	38.9	429,482	29.1	65.0
Special service	57,756	3.4	137,114	9.3	237.4
Flat:					
General purpose	56,124	3.3	36,751	2.5	65.5
Special service 1/	--	--	13,146	.9	--
Gondola	280,536	16.5	202,421	13.7	72.2
Hopper:					
Open top	506,449	29.8	415,275	28.1	82.0
Covered	42,609	2.5	118,111	8.0	277.2
Refrigerated	19,849	1.2	51,314	3.5	258.5
Rack	25,559	1.5	49,399	3.3	193.3
Stock	37,922	2.2	16,694	1.1	44.0
Tank	6,737	.4	4,659	.3	69.2
Other	4,079	.3	2,800	.2	68.6
Total	1,698,814	100.0	1,477,166	100.0	87.0

1/ There was no breakdown of flatcars in 1955.

Source: (12, table 22).

Railcars owned by car companies and shippers showed an almost steady increase from 1955 to 1967 (table 4). The bulk were special service cars, but some general purpose railcars--boxcars, gondola cars, and open hopper cars--were also owned by nonrailroad companies. The percentage of each type owned varied little over the period. Class I railroads, on the other hand, increased their ownership of special service cars 110.8 percent from 1959 to 1967 (table 5). This compares with an increase of 20.7 percent for private companies. While car companies are an important source of railcars, it is apparent that shippers are becoming increasingly dependent on the railroads for specialized equipment.

Table 2.--Distribution of general purpose boxcars, special service boxcars, and covered hopper cars owned by Class I railroads, by district, 1955 and 1967

District	1955		1967		Percentage of 1955
	Cars	Percentage of U.S. total	Cars	Percentage of U.S. total	
	Number	Percent	Number	Percent	Percent
Eastern	313,559	41.2	222,986	32.6	71.1
Southern	107,935	14.2	120,809	17.6	111.9
Western	340,065	44.6	340,912	49.8	100.2
U.S. total	761,559	100.0	684,707	100.0	89.9

Source: (12, table 21).

Table 3.--Aggregate capacity of general purpose boxcars, special service boxcars, and covered hopper cars owned by Class I railroads, by district, 1955 and 1967

District	1955		1967		Percentage of 1955
	Aggregate capacity of cars	Percentage of U.S. total	Aggregate capacity of cars	Percentage of U.S. total	
	Mil. tons	Percent	Mil. tons	Percent	Percent
Eastern	15.5	41.2	13.2	32.3	84.7
Southern	5.4	14.4	7.6	18.5	139.6
Western	16.8	44.4	20.1	49.2	119.9
U.S. total	37.7	100.0	40.9	100.0	108.3

Source: (12, tables 21 and 22).

FREIGHT HAULED

Despite the considerable decrease in total railcars from 1955 to 1967, tonnage hauled rose slightly. Class I railroads increased revenue freight originated from 1,389.6 million tons in 1955 to 1406.7 million tons in 1967. On the average, this freight moved farther in 1967 than in 1955--total ton-miles increasing from 623.6 million to 719.4 million during the period (fig. 3).

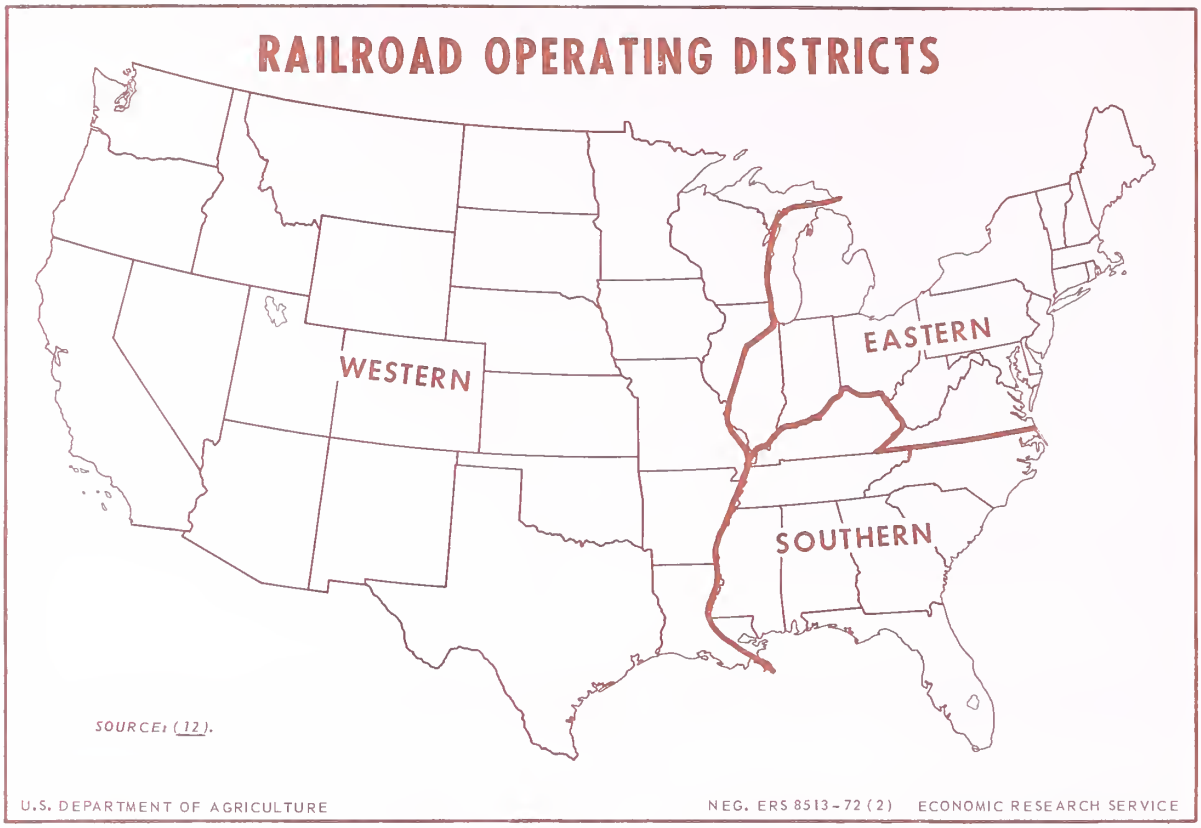

Figure 2

As shown in table 6, traffic hauled in general purpose boxcars, special service boxcars, and covered hopper cars increased at a considerably greater rate than total traffic--397.8 million tons in 1955, compared with 473.6 million tons in 1967. All regions did not share in this gain, however. Tonnage of products moved declined 9.2 percent in the Eastern District but rose 39.6 percent in the Southern District and 19.9 percent in the Western District.

When compared with changes in car capacity, increases or decreases in revenue freight originated reflect little change in the relationship among regions. However, when terminations are compared with originations, the pressures that account for the differences in regional car supplies are more apparent (table 7). The Eastern District, while declining in originations and terminations, substantially increased its surplus of terminations. Both the Southern and Western Districts experienced a surplus of originations. The Western District, historically the region with the greatest car supply problem, experienced a considerable deterioration in its position.

Table 4.--Railcars owned by car companies and shippers, by type, as percentage of total cars owned, 1955-67

Year	Special service railcars 1/		General purpose railcars		Total railcars	
	Number	Percent	Number	Percent	Number	Percent
1955	--	--	--	--	285,526	100
1956	--	--	--	--	288,735	100
1957	--	--	--	--	294,921	100
1958	--	--	--	--	291,859	100
1959 2/	256,057	84.1	48,270	15.9	304,327	100
1960	268,024	83.4	53,483	16.6	321,507	100
1961	266,691	82.7	55,882	17.3	322,573	100
1962	258,540	79.5	66,649	20.5	325,189	100
1963	271,289	81.0	63,482	19.0	334,771	100
1964	280,699	82.4	63,996	18.6	344,695	100
1965	285,818	82.2	61,767	17.8	347,585	100
1966	298,693	82.0	65,513	18.0	364,206	100
1967	309,003	82.6	65,139	17.4	374,142	100

1/ Special service railcars include refrigerated cars, tank cars, and other specialized equipment. General purpose railcars include boxcars, gondola cars, and open hopper cars.

2/ Comparable breakdown in car types was not available from ICC data prior to 1959.

Source: (13).

FREIGHT CAR UTILIZATION

Besides the total number and carrying capacity of freight cars, the number of times per year that each car is available for loading is significant also in determining if the supply of empty cars is adequate for shippers' needs. This availability depends upon the speed of movement of cars, frequency and duration of repairs, and time spent loading and unloading.

Level of Utilization

During 1962-67, freight car-days available for use in the United States averaged 692 million a year. Of these, 125 million car-days, or 18.1 percent of the total, were spent in loading and unloading activities (table 8). Switching and running service or unallocated time accounted for the remainder.

The data shown in table 8 are national aggregates based in part on one-time studies by the ICC or specific railroads and are not conclusive. Nonetheless, they suggest that switching and "unallocated" activities should receive more attention than loading and unloading as areas for obtaining relief of car

shortages. Since almost 82 percent of total car-days are spent in railroad operations, modest improvements in car utilization by railroads would have considerably more impact on the availability of cars than would a comparable improvement by shippers and receivers.

Table 5.--Railcars owned by Class I railroads, 1955-67 1/

Year	Special service railcars		General purpose railcars		Total railcars	
	Number	Percent	Number	Percent	Number	Percent
1955	152,510	9.0	1,546,304	91.0	1,698,814	100
1956	156,713	9.2	1,550,126	90.8	1,706,839	100
1957	168,511	9.7	1,577,210	90.3	1,745,721	100
1958	172,386	10.0	1,551,842	90.0	1,724,228	100
1959	177,264	10.6	1,499,122	89.4	1,676,386	100
1960	187,978	11.3	1,470,314	88.7	1,658,292	100
1961	193,345	12.1	1,410,896	87.9	1,604,241	100
1962	204,494	13.2	1,345,573	86.8	1,550,067	100
1963	221,610	14.7	1,290,696	85.3	1,512,306	100
1964	245,542	16.5	1,242,843	83.5	1,488,385	100
1965	295,896	20.0	1,182,109	80.0	1,478,005	100
1966	340,939	22.9	1,147,176	77.1	1,488,115	100
1967	373,743	25.3	1,103,423	74.7	1,477,166	100

1/ Special service railcars include special service boxcars, covered hopper cars, refrigerated cars, rack cars, tank cars, and for 1965-67, special service flatcars. General purpose railcars include all other cars owned by Class I railroads.

Source: (12, table 22).

Improvements in Railroad Operations and Equipment

Measures to improve railroad operations and equipment may not be directed specifically toward solving the freight car supply problem, but they help in alleviating it. Between 1955 and 1967, originated tonnage on Class I railroads increased 3.8 percent, traveled 14.1 percent farther, and was moved by 12.4 percent fewer cars. This was accomplished by various improvements in operations and equipment--increases in average car capacity (from 54 to 63 tons), average car load (from 42 to 51 tons), total car capacity, train speed, and cars per train, and a decrease in the time cars were unserviceable (table 9). Centralized traffic control also expanded considerably during 1955-67 and was a contributing factor to the increased efficiency. The latter part of the period was marked by a sharp growth in capital expenditures, much of it for special service boxcars and other improved equipment. Special service boxcars are larger in size than general purpose boxcars and are adapted to hauling bulky items such as major appliances. They have wide doors that

permit the use of modern materials-handling methods and cushioned underframes to reduce or eliminate the damage caused by "humping" (jolting cars in starting and stopping).

Covered hopper cars--another form of specialized equipment--are widely used to carry grain and other bulk cargo. These cars have roof hatches for loading and hopper outlets for unloading. Most have a large capacity--100 tons in the case of the Southern Railway System's "Big John" hopper car. Covered hopper cars are more limited than general purpose boxcars in the cargoes they can haul; however, this restriction may be an asset since it encourages the prompt return of empty cars.

Another specialized car on the increase is the flatcar used to haul truck trailers. Piggyback loadings of flatcars rose from 168,000 carloads in 1955 to 1,207,000 in 1967 (2, p. 33). The growing popularity of these cars can be attributed to their rapid turnaround rate (three times as fast as the average freight car) (5, p. 35), and the convenience of this type of intermodal service.

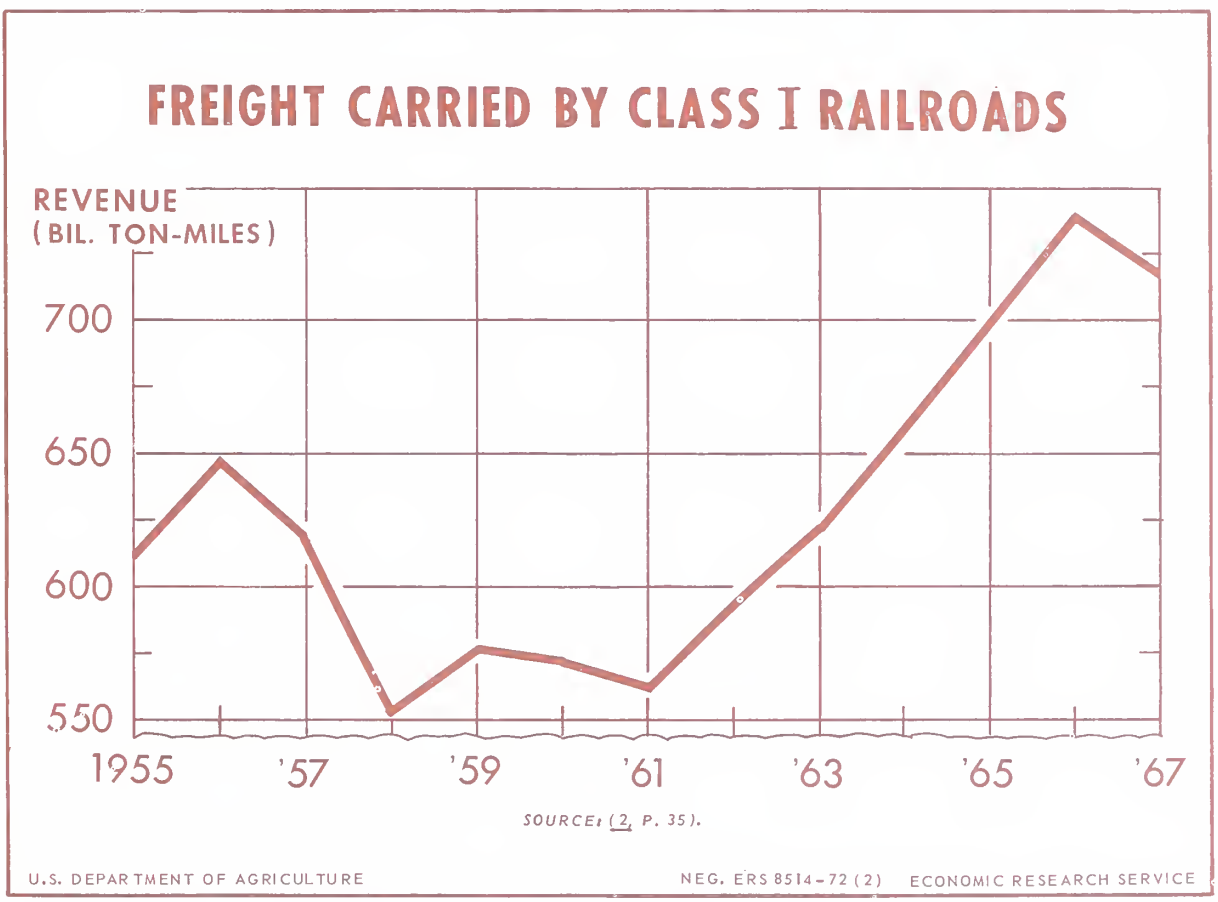

Figure 3

Table 6.--Estimated railroad freight hauled by Class I railroads, in general purpose boxcars, special service boxcars, and covered hopper cars, by district, 1955 and 1967

Year and freight type	Eastern District			Southern District			Western District			U.S. total	
	Tons of freight originated	Percentage		Tons of freight originated	Percentage		Tons of freight originated	Percentage		Tons of freight originated	
		Dist.	U.S. total		Dist.	U.S. total		Dist.	U.S. total		Percentage
	Mil. ton	Percent		Mil. ton	Percent		Mil. ton	Percent		Mil. ton	Percent
1955											
Raw materials	24.7	15.5	22.6	10.1	18.5	9.2	74.7	40.7	68.2	109.5	27.5
Manufactured goods	135.1	84.5	46.9	44.5	81.5	15.4	108.7	59.3	37.7	288.3	72.5
Total	159.8	100.0	40.2	54.6	100.0	13.7	183.4	100.0	46.1	397.8	100.0
1967											
Raw materials	15.2	10.5	13.6	15.0	15.7	13.4	81.9	35.2	73.0	112.1	23.7
Manufactured goods	129.9	89.5	35.9	80.6	84.3	22.3	151.0	64.8	41.8	361.5	73.6
Total	145.1	100.0	30.6	95.6	100.0	20.2	232.9	100.0	49.2	473.6	100.0

Source: (9).

Table 7.--Originations and terminations of estimated freight hauled by Class I railroads in general purpose boxcars, special service boxcars, and covered hopper cars, by district, 1955 and 1967

Revenue freight and year	Eastern District	Southern District	Western District
	Percent	Percent	Percent
1955			
Originated	40.2	13.7	46.1
Terminated	41.4	14.6	44.0
Difference	+ 1.2	+ 0.9	- 2.1
1967			
Originated	30.6	20.2	49.2
Terminated	34.0	20.1	45.9
Difference	+ 3.4	- 0.1	- 3.3

Source: (9).

Table 8.--Average annual car-day activity, all cars in service, 1962-67

Activity	Car-days per year	Percentage of total
	Million	Percent
Switching	240.2	34.7
Loading and unloading	125.2	18.1
Running service	59.7	8.6
Unallocated car-days and repairs	267.1	38.6
Total	692.2	100.0

Source: (11 and 12, table 22).

Another innovation, the unit train, has gained widespread use in transporting bulk commodities such as coal. These trains consist of a number of cars of the same type and usually move between specific points. They travel faster than regular freight trains and eliminate time spent in switching and classification yards. Although some grain moves by unit trains, the widely scattered locations of many elevators on branch lines preclude their use by many shippers.

Table 9.--Operating performance features of Class I railroads, 1955-67

Year	Average freight car capacity	Average freight car load	Total freight car capacity	Unserviceable freight car-days as percentage of total	Average daily car miles	Average train speed	Average cars per train	Centralized traffic control track	Capital expenditures
	Tons	Tons	1,000 tons	Percent	Miles	M.p.h.	Number	Miles	1,000 dollars
1955	53.7	42.4	91,229	5.2	48.2	18.6	65.5	28,428	909,521
1956	54.0	43.1	92,161	3.8	48.3	18.6	66.5	29,588	1,227,857
1957	54.5	43.8	95,084	4.3	47.0	18.8	68.6	32,033	1,394,705
1958	54.8	43.5	94,486	6.8	43.6	19.2	70.1	33.241	738,036
1959	55.0	43.5	92,265	7.7	45.9	19.5	69.0	34,008	818,002
1960	55.4	44.4	91,947	7.8	45.7	19.5	69.6	35,997	919,154
1961	55.7	44.9	89,292	8.4	45.5	19.9	70.4	38,264	646,425
1962	56.3	45.4	87,224	7.6	47.6	20.0	70.5	39,918	832,938
1963	56.8	46.7	85,943	7.0	49.2	20.1	70.3	40,670	1,043,788
1964	58.3	47.8	86,771	5.4	50.0	20.2	69.7	42,282	1,417,263
1965	59.7	48.9	88,231	5.1	51.7	20.1	69.6	44,025	1,630,687
1966	61.4	50.1	91,441	4.4	53.0	20.3	69.3	44,758	1,952,805
1967	62.9	51.3	93,669	4.6	51.5	20.3	70.5	46,100	1,522,087

Source: (2 and 12, table 8).

Seasonality of Utilization

Car numbers, aggregate capacity, and utilization provide an overall view of freight car supplies, but do not take into account seasonality of demand. In 1968, all common carriers by railroads subject to the Interstate Commerce Act were required to participate in a study to develop car supply on performance information at the station level. Data were collected from Class I and Class II railroads on railcar placements, deficiencies, and shortages. Results of the study are discussed in Ex Parte No. 252 (Sub: No. 1) (8) and are limited to plain boxcars. The data are aggregated for each of six zones comprising the historical ratemaking terriories (8 and table 10). Placements were defined as boxcars placed at a shipper's request at a station on a particular day, and deficiencies in placements as orders outstanding and current orders for that day minus cancellations and placements (not in excess of orders). Shortages were orders outstanding and current orders for that day minus cancellations and cars available at the station.

Deficiencies in placements were approximately 38 percent of placements, and shortages were 19 percent of placements. Daily car placements average 18,622; deficiencies in placements, 7,131; and shortages, 3,570. As shown in figure 4, deficiencies in placements were highest during February, October, and November; shortages were most severe during October and November. Deficiencies in placements and shortages were accumulated daily over each time period. However, they are not a true indication of cars needed, since outstanding orders may be filled or canceled on succeeding days (8, p. 199). Thus, accumulated deficiencies in placement and shortages are only useful in showing the seasonal trends in demand for boxcars.

Despite the limitations of the data on car supply, the ICC study found that deficiencies in car placements and car shortages were not uniformly distributed nationally (table 11). Both deficiencies in placements and shortages were far greater in the Midwest than in any other zone (table 11). The Southwest had the lowest percentage of deficiencies in placements; the South had the lowest percentage of shortages. In the Midwest zone, approximately 67 percent of the deficiencies in placements and 78 percent of the shortages were from September through February, the period of heaviest grain loading.

INCENTIVES GUIDING EMPTY CAR ALLOCATIONS

Unlike total demand, the total supply of freight cars does not vary in the short run. Moreover, according to Weisbrod, empty car movements vary inversely with traffic (23, pp. 383-385). Consequently, unless the incentives guiding the allocation of empty cars are adjusted from time to time to reflect shippers' demands, the regional and seasonal imbalances in railcar supply suggested by the ICC study discussed above would be expected.

Important elements of the incentives guiding the allocation of empty cars have changed considerably since 1964. Among these are (1) car rental rates paid by a railroad for the use of a car belonging to someone else; (2) car service and distribution rules; and (3) demurrage rates paid by shippers and receivers for holding cars beyond the time limits established in published tariffs. (These incentives are discussed below.) It should be noted that,

although car ownership creates a legal basis for limiting the uses made of cars belonging to another party, the Interstate Commerce Act requires all railroads to participate in through-route and joint-rate arrangements, and nonowning roads must accept cars when offered under these arrangments. Thus, car ownership cannot be the sole criterion for determining car disposition.

Per Diem

Since a substantial part of the life of most railcars is spent on other than their home roads (approximately 65 percent of the total life of plain boxcars) (1), some system of compensation was needed to reimburse the owning road for that time. Per diem--rental paid by one railroad to another for the use of a car--evolved from that need. Although payments of this type existed as far back as 1867, there was no uniform rental agreement among railroads until July 1, 1902. At that time, the Association of American Railroads (AAR) adopted the Code of Per Diem Rules prepared by its Committee on Car Service. This agreement, with modifications, is still in effect.

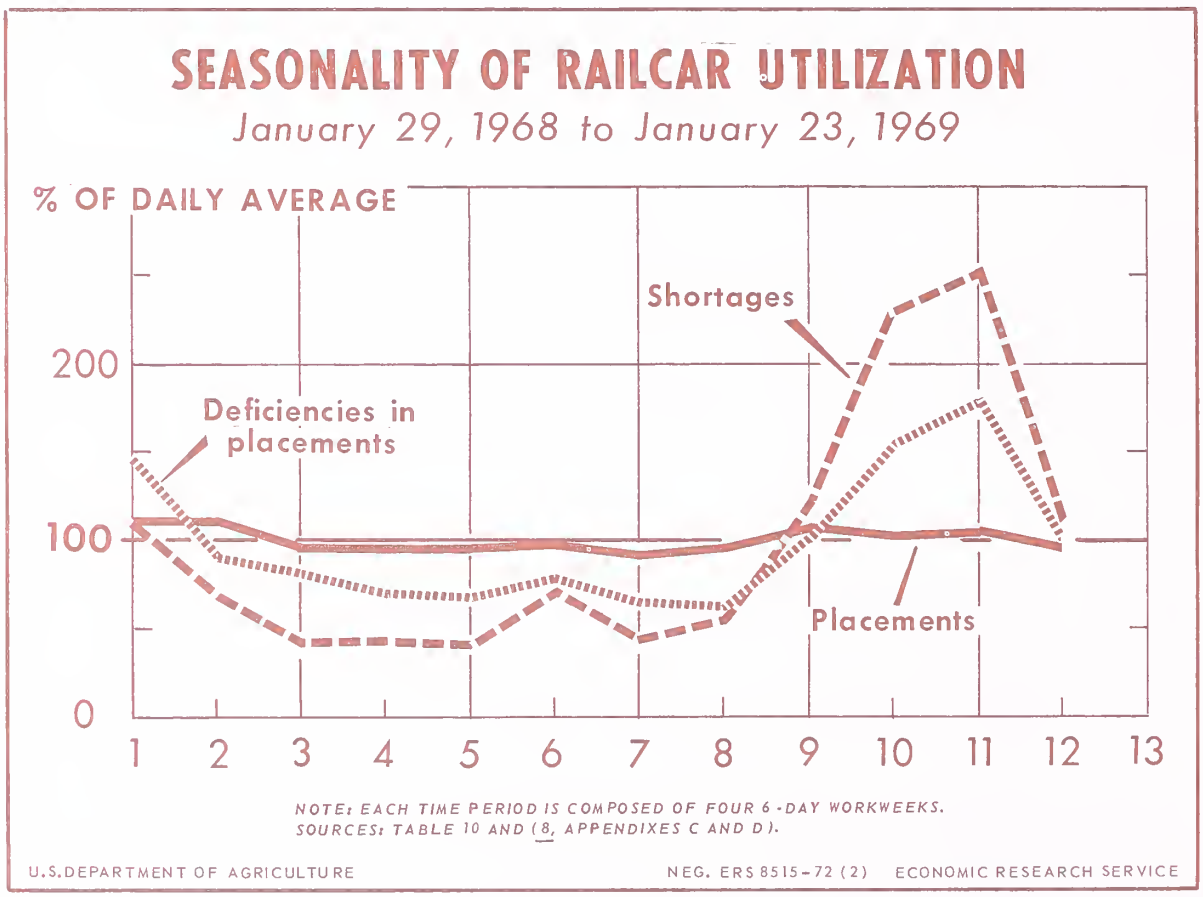

Figure 4

Table 10.--Plain boxcar placements, deficiencies in placements, and shortages, selected periods, January 29, 1968, to January 23, 1969

Period	Placements		Deficiencies in placements		Shortages	
	Total	Percentage of total	Total	Percentage of total	Total	Percentage of total
	Number	Percent	Number	Percent	Number	Percent
1968:						
Jan. 29-Feb. 24	499,728	9.3	251,592	12.2	95,208	9.3
Feb. 26-Mar. 23	498,192	9.3	156,432	7.6	59,808	5.8
Mar. 25-Apr. 20	428,016	8.0	144,504	7.0	36,024	3.5
Apr. 22-May 18	426,600	7.9	121,128	5.9	37,512	3.7
May 20-June 15	428,448	8.0	115,032	5.6	35,280	3.4
June 17-July 13	436,512	8.1	135,240	6.6	60,912	5.9
July 15-Aug. 10	405,840	7.6	112,008	5.5	37,248	3.6
Aug. 12-Sept. 7	428,208	8.0	107,928	5.3	46,728	4.6
Sept. 9-Oct. 5	471,360	8.8	172,296	8.4	104,280	10.1
Oct. 7-Nov. 2	446,400	8.3	260,544	12.7	193,992	18.9
Nov. 4-Nov. 30	465,744	8.7	306,840	14.9	223,944	21.8
Dec. 2-Dec. 30						
1969:						
Jan. 2, 8, 9, 16, and 23	428,064	8.0	170,304	8.3	97,128	9.4
Total	5,363,112	100.0	2,053,848	100.0	1,028,064	100.0

Source: (8, appendixes C and D).

Table 11.--Total plain boxcar placements, deficiencies in placements and shortages, by zone, January 29, 1968, to January 23, 1969

Zone	Total Placements	Deficiencies in placements		Shortages	
		Total	Percentage of total placements	Total	Percentage of total placements
	Number	Number	Percent	Number	Percent
New England 1/ ...	---	---	---	---	---
Great Lakes-Mid-Atlantic ...	1,659,280	593,136	35.7	348,528	21.0
South ...	1,109,856	357,840	32.2	72,504	6.5
Midwest ...	1,158,144	682,896	59.0	451,440	39.0
Southwest ...	521,472	128,328	24.6	40,080	7.7
Pacific ...	708,576	271,464	38.3	67,008	9.5

1/ Data withheld due to high variability in the estimate.

Source: (8, appendixes C and D).

The first per diem rates arising from the 1902 code were a compromise between existing payments for mileage and rates consistent with changes in prices of cars and materials. In 1908, the presidents of five leading railroads were appointed to a special commission to outline the principles by which the per diem rate should be determined. The McCreas Commission, as it was subsequently known, "decided that the following elements have to be included in the calculation of freight car expense: (1) cost of repairs; (2) cost of replacement (depreciation and retirement); (3) cost of taxes; (4) interest on cost; and (5) other allowances incident to ownership." (6, pp. 53-54) Since this formula did not include an allowance for the revenue-producing potential of the car in various uses, it did not encourage the most efficient use of equipment.

Although per diem rates are intended to return ownership costs, historically they have stayed at a low level, regardless of the original cost of the car. In 1902, the per diem rate was $0.20 a day; in 1959, it was $2.88 (table 12). Despite almost steadily rising ownership costs, per diem rates changed only 17 times between 1902 and 1964. This disparity indicates that changes in per diem rates lagged behind changes in ownership costs most of the time.

Some observers maintain that the low level of per diem rates in effect until 1964 had several adverse effects on railcar supplies. By utilizing cars belonging to other roads whenever possible, railroads had less incentive to purchase new cars. Any new cars that were bought were likely to be the lowest cost type instead of the more expensive cars used in interchange service.

Prior to 1964, railroads generally used their newest, specialized equipment only on their own lines or released it to other railroads under strict conditions that ensured its prompt return to the home road (17, p. 112). Despite regulations to the contrary, some railroads may have also permitted cars to stand idle for unreasonable lengths of time waiting for loads in the direction of the cars' home road or they may have been encouraged to violate car service rules and use cars for traffic not directed closer to or on home roads (22, p. 21).

How per diem rates should be calculated has been the subject of numerous studies. Yehuda Grunfeld, University of Chicago, commented in 1959: "The main reason for the permanent controversy on the proper way to calculate the per diem rate is that the concept of 'fair yield' which has been taken as the conceptual basis for these rates is unsatisfactory . . . Many of the economic functions that an optimal per diem structure can perform are presently effected by direct controls of the AAR or the ICC. It is the function of a good pricing system for car rentals to dispose of as many direct controls as possible . . ." (6, pp. 54-55)

According to Grunfeld, the per diem rate structure will have a direct effect on the number and type of cars purchased by the railroads. At the same time, a per diem scheme which assures an optimal number of cars purchased will not necessarily assure an optimal allocation of cars among roads at each point in time (6, p. 56). (It should be noted that no consideration is given to whether a per diem system can be used to satisfy shippers' demands for railcars.)

Assuming a 6-percent return on investment and a car with an expected life of 30 years, the 1957 per diem rate of $2.75 would reimburse an owner fairly for a car costing approximately $6,400 (6, p. 62). However, ICC data show that the average cost of new railcars in 1959 ranged from $8,715 for a regular hopper car to $15,667 for a refrigerated car. Using Grunfeld's analysis, the $2.88 per diem in effect in 1959 would not have fully compensated the owner of even the lowest priced new car.

Table 12.--Per diem rates for railroad freight cars, 1902-63

Year initiated	Per diem rates	Year initiated	Per diem rates
	Dollars		Dollars
1902	0.20	1920	0.90
1906	.25	1920	1.00
1907	.50	1945	1.15
1908	.25	1947	1.25
1910	.30	1949	1.75
1910	.35	1952	2.00
1913	.45	1953	2.40
1916	.75	1957	2.75
1917	.60	1959	2.88

Source: (5, p. 28).

Graduated Per Diem Scale

On January 1, 1964, the AAR, realizing the need for a change in the prevailing per diem system, instituted a graduated scale of per diem rates based on "original cost per car depreciated" (table 13). These rates ranged from $2.16 for a railcar valued at $1,000 or less to $7.74 for a car costing $20,000 or more. The scale was modified on March 1, 1965, and the maximum charge became $12.18 for a car costing $35,000 or more, with subsequent rates for different costs above the previous maximum.

An examination of various aspects of rail ownership by Class I railroads during 1955-67 reveals some interesting insights into the ways original cost and per diem rates influence railcar ownership. As shown in figure 5, railcar numbers increased slightly from 1955 to 1958, then declined almost steadily to 1967.

Table 13.--Per diem rates for the use of railroad-owned freight cars operating between common carrier railroads, March 1, 1965

Original cost of car less depreciation	Per diem group	Per diem rate per car-day
		Dollars
$1,000 or less	1	2.16
1,000.01 to 5,000	2	2.79
5,000.01 to 10,000	3	3.58
10,000.01 to 15,000	4	4.50
15,000.01 to 20,000	5	6.15
20,000.01 to 25,000	6	7.11
25,000.01 to 30,000	7	9.00
30,000.01 to 35,000	8	10.18
35,000.01 and over	9	12.18

Source: (5, p. 32).

As expected, Class I railroads owned considerably more general purpose, than special service, railcars during 1955-67. However, over the period, substantial changes occurred in the percentage distribution of these cars. General purpose cars decreased 28.6 percent from 1955 to 1967, while special service cars increased 145 percent (fig. 5). Special service cars increased from 9 percent of the total Class I railroad car fleet in 1955 to 25.3 percent in 1967.

Installation of special service cars increased 560 percent from 1955 to 1967, compared with 22 percent for general purpose cars (fig. 6). In purchases, special service cars shifted from a minor to a dominant position. In 1955, they accounted for 19.5 percent of new cars purchased, compared with

56.7 percent in 1967 (table 14). Most of the special service railcars could have been purchased at the beginning of the 1955-67 period, indicating that increased purchases were influenced by the change in the per diem system.

The patterns of ownership and purchase of new railcars by Class I railroads during the 1955-67 period provide rather strong support for Grunfeld's hypothesis that the flat per diem rates in existence from 1902 to 1964 gave insufficient incentive to railroads to purchase an adequate supply of special service equipment to meet the demand. If the supply of freight cars is to keep up with demand, according to Grunfeld, per diem rates should be in line with the cost of new cars, not the average value of the existing fleet. The 1964 per diem agreement, which included this feature, must be considered a positive influence on car supply. Other factors such as an expanding economy, accelerated retirement of older equipment, and competitive pressures may have also affected the purchase of new railcars during the period.

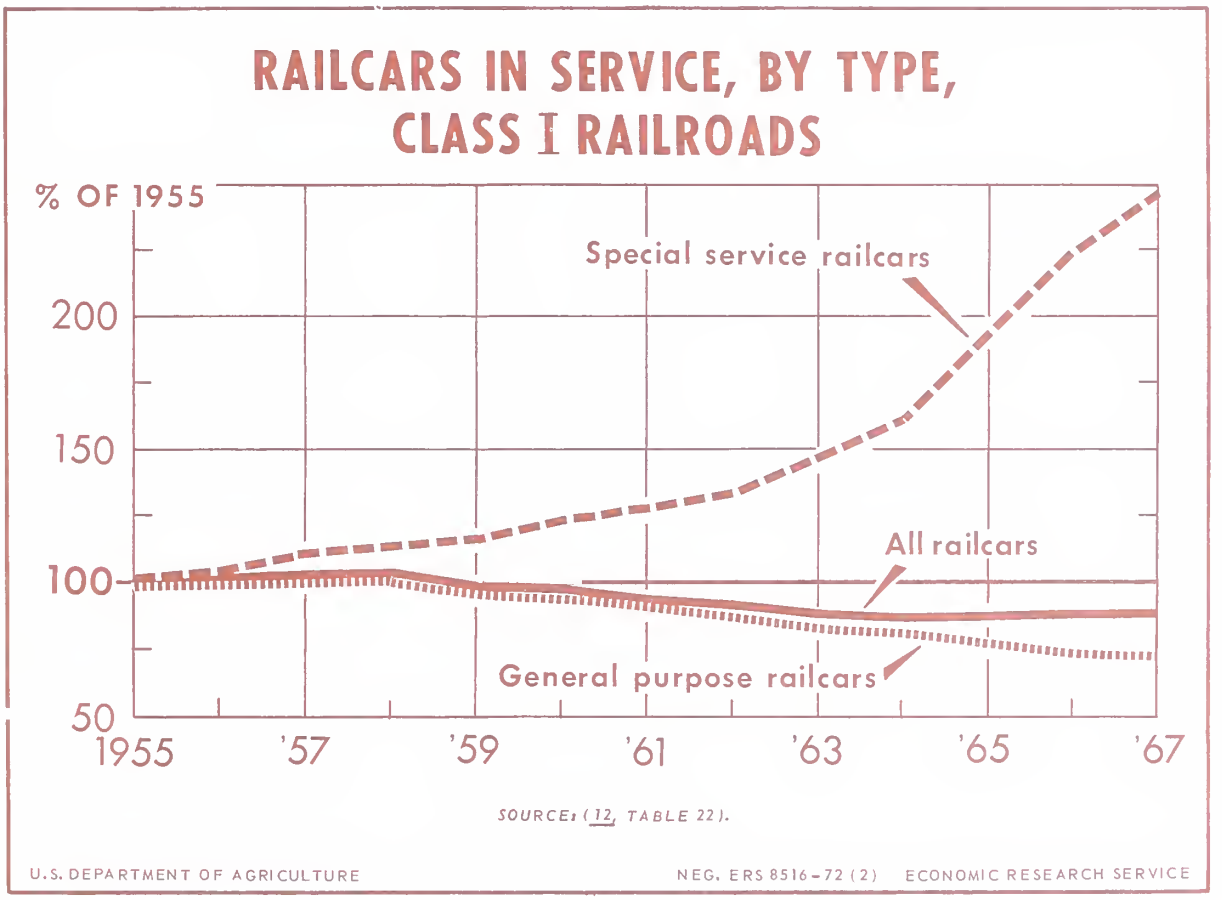

Figure 5

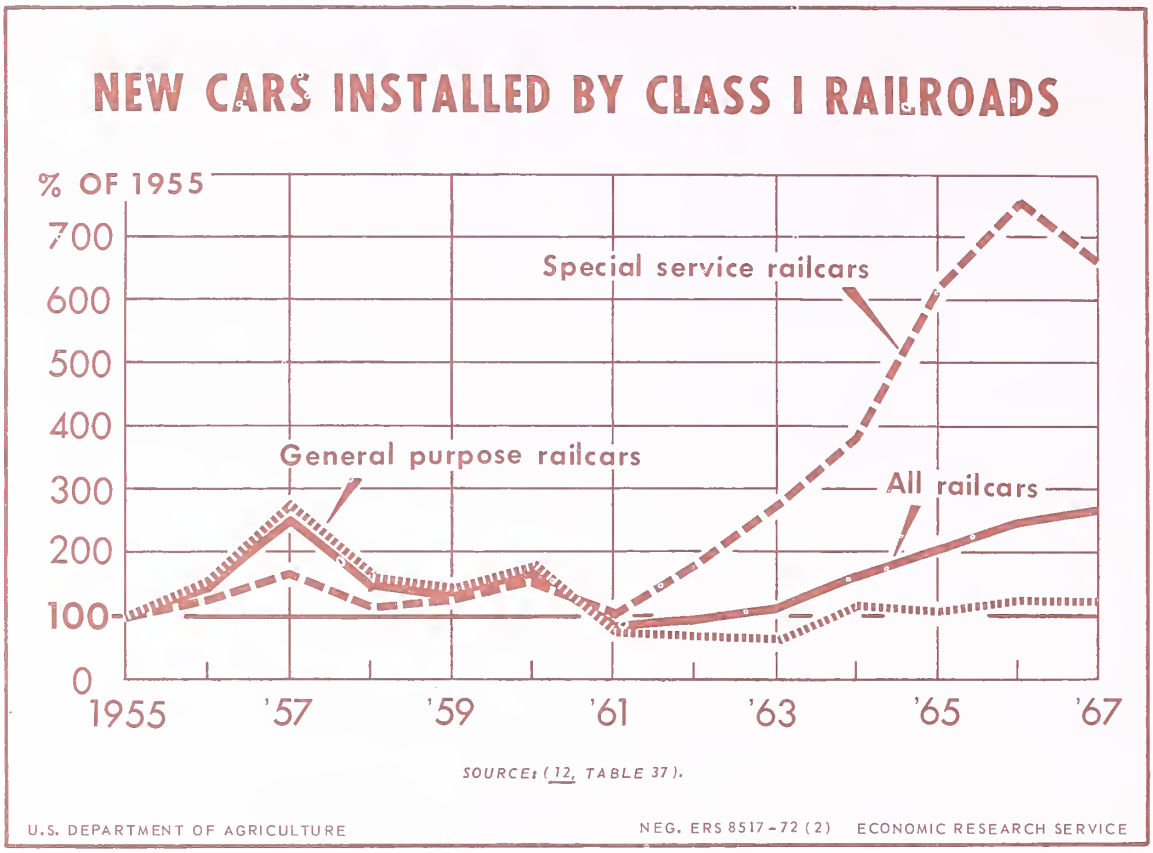

Figure 6

Time-and-Mileage Car Rentals

On January 20, 1968, the ICC ruled that U.S. railroads must pay car rental rates based on daily car rentals plus mileage charges (7). This new system of car rental rates became effective in August 1970 and was retroactive to August 1969. The ruling resulted from disagreements between railroads with different operating characteristics concerning the equitability of flat and/or graduated per diems.

The ICC determined that car rentals must take into account both elapsed time and amount of activity, the latter being measured by the mileage a car moves. Rules for determining time-and-mileage payments included the following provisions:

(1) Cost of maintenance and repairs should be distributed equally between time and mileage;

(2) Depreciation should be spread over 30 years, allowing 3 percent of the original cost per year and distributing the annual amount 40 percent to mileage and 60 percent to time;

(3) Ownership costs should be closely related to the original costs of cars to permit reasonable compensation to the owner; and

(4) Rates productive of such compensation should vary no more than $2,000 within original cost brackets (7, p. 258).

Table 14.--Special service and general purpose railcars purchased, built, and leased by Class I railroads, 1955-67

Year	Special service railcars		General purpose railcars		Total railcars	
	Number	Percent	Number	Percent	Number	Percent
1955	5,979	19.5	24,741	80.5	30,720	100
1956	7,292	16.2	37,713	83.8	45,005	100
1957	10,076	13.0	67,287	87.0	77,363	100
1958	6,709	14.2	40,617	85.8	47,363	100
1959	7,738	18.3	34,550	81.7	42,288	100
1960	9,427	17.5	44,337	82.5	53,764	100
1961	6,058	23.3	19,992	76.7	26,050	100
1962	10,533	36.2	18,592	63.8	29,125	100
1963	16,297	49.4	16,675	50.6	32,972	100
1964	22,643	43.6	29,285	56.4	51,928	100
1965	37,013	59.0	25,679	41.0	62,692	100
1966	44,760	59.6	30,297	40.4	75,057	100
1967	39,467	56.7	30,200	43.3	69,667	100

Source: (12, table 37).

Time-and-mileage per diem is classified into 21 cost brackets and seven age categories. Mileage charges are based on the 21 cost brackets. However, time charges are based on both cost brackets and age categories for a total of 147 categories. Charges range from $0.63 per day and 1.47 cents per mile for cars over 30 years old costing $1,000 or less, to $10.22 per day and 4.6 cents per mile for cars under 6 years of age costing $39,000-$41,000 (7, pp. 242 and 243).

Because considerable opposition developed to these time-and-mileage car rentals, specific legislation has been introduced that would direct the ICC to prescribe a car rental system based solely upon the time a car is held or used (21).

"Critics of time-and-mileage per diems maintain that under the time-mileage formula, it will become cheaper to hold cars than to move them, and to use cars owned by others than to buy them." (19, p. 138) Arguments for time-and-mileage rentals are based on the premise that roads with short-line hauls and/or numerous branch lines require cars to stand longer than those with long-line hauls and are thus penalized by flat or graduated per diems based only on

time considerations. Further, car rentals based only on time considerations could encourage a railroad to relinquish control of a car sooner than justified by traffic expectations.

The above arguments for time-and-mileage rentals have some validity if justice and equitability are the primary considerations. However, regional imbalances of originations and terminations are so severe from one season to another as to weigh heavily toward a car rental system that would alleviate them.

One possible result of time-and-mileage car rentals might be to discourage the prompt return of empty boxcars. Between 1952 and 1967, approximately 224,000 new general purpose boxcars were purchased, built, or leased by Class I railroads (12, table 22). This indicates that about 205,500 general purpose boxcars or not less than 47 percent of the 1967 fleet of 429,500 cars were purchased prior to 1952. The average cost of new general purpose boxcars was $6,713 in 1954, $6,346 in 1953, and $5,859 in 1952 (12, table 37). This trend indicates that the average cost of cars purchased before 1952 would not have exceeded these amounts. A railcar in the over-15-years-old class and costing less than $7,000 would be subject to a time-and-mileage charge of 1.87 cents per mile and $1.50 per day or less. Under the graduated per diem scale, a car costing $7,000 and over 15 years old would be depreciated to less than $4,000 and would be subject to a per diem charge of $2.79 a day. This assumes the car is depreciated from its original cost and would have no costs added for additions and betterments (7, p. 266).

ICC data indicate that the average freight car traveled approximately 15,700 miles in 1967 and was available for service 348 days (365 days' less 17 days' repair time). Under the time-and-mileage charge cited above, rental of one of these older cars belonging to another railroad would have cost the using railroad only $816 in 1967, compared with $971 under the graduated scale ($2.79 per day). A new general purpose boxcar purchased at an average price of $12,000 in 1967 would have cost the owning railroad approximately $1,557 per year to own (7, p. 242). Thus, under the time-and-mileage scale, a railroad could have saved $741 per car in 1967 by utilizing older cars belonging to another railroad instead of purchasing new ones. Under the graduated scale, the savings would have been considerably less, or $586. A new railcar would probably have a greater earning potential than an old car, but it is doubtful that it would approach 91 percent more in the case of the time-mileage per diem or 60 percent more in the case of the graduated per diem.

Since much of the traffic originated on one railroad is terminated on another, it is logical to assume that a road could not hold cars belonging to other roads for extended periods of time. Therefore, a look at another possible effect of time-and-mileage per diems is in order. There are charges that have to be met whether a car is loaded or empty on its return to the owning railroad. However, a car could be held additional days at a cost of $1.50 per day under time-and-mileage per diems, compared with $2.79 per day under the graduated scale. Under the time-and-mileage scale, a car could be held almost twice as long at the same cost as under the graduated scale, in anticipation of finding a revenue-producing load directed toward the owning road.

The probable effect of the 1969 time-and-mileage car rentals on the general purpose boxcar fleet will be to delay the return of older, lower valued cars to their owners. However, this result may be partially offset by ICC's 1970 incentive per diem order discussed below.

Incentive Per Diem System

On April 28, 1970, the ICC issued an order instituting an incentive per diem system June 1, 1970. This system requires an additional daily charge to be paid to per diem accounts for general purpose boxcars during September-February.

The ICC, after investigating the adequacy of the national railcar supply, " . . . announced a provisional judgment with respect to the form and amount of an incentive per diem charge which will provide just and reasonable compensation to freight car owners, contribute to sound car service practices (including efficient utilization and distribution of cars), and encourage the acquisition and maintenance of a car supply adequate to meet the needs of commerce and the national defense . . . ." (8, p. 218) 6/

Incentive per diem is expected to attack the boxcar shortage in two ways. First, it should speed up the use and return of cars to their owners; and second, it should provide a fund for purchase of more boxcars to add to the fleet.

To implement the second point the ICC ordered " . . . that net incentive balances, i.e., the excess of incentive charges received by a railroad over those paid by it, should be set aside as earmarked funds for the purchase, building, or rebuilding of general service, unequipped boxcars." (8, p. 277) To ensure the purchase or rebuilding of cars, it was specified that the earmarked funds could be drawn upon by the recipient to build or purchase new cars only after the 1964-68 average number of such boxcars had been purchased or built from other funds (8, p. 228). The same principle applied to rebuilding cars.

Incentive per diem charges are based on the same cost and age categories as the daily charge under the time-and-mileage scheme. They range from 4 cents per day for cars over 30 years old costing $1,000 or less, to $12.98 per day for cars under 6 years of age costing $39,000-$40,000 (8, appendix A).

Since approximately 47 percent of the general purpose boxcars cost less than $7,000 and were over 15 years old in 1967, the incentive payment for these cars would range from 4 cents to $1.00 per day. With the percentage of older cars expected to increase, according to ICC data, these low incentive rates may not be sufficient to generate a significant change in the boxcar supply problem.

Since "the earmarking requirement would apply only to the net credit

---

6/ A Federal court in Florida has exempted two railroads from paying the incentive per diems. The court ruled that "the Interstate Commerce Commission order establishing the per diem payments was unlawful...because the carriers were not given a hearing on the matter before the agency." (20, p. 63)

balances resulting from the payment of the incentive charges" (8, p. 191), it is doubtful that a very large earmarked fund will be generated each year. Therefore, the primary effect of the incentive per diems will probably be to encourage railroads to return empty cars more promptly to owning railroads.

The incentive per diem charges recognize the seasonality of demand for general purpose boxcars. This recognition of shortrun fixed car supply and variable demand in aggregate is necessary if the pricing system is to be an effective factor in railcar deployment (4). However, it may not be adequate to achieve the best geographical distribution of empty cars. More flexibility in per diem rates may be required if the pricing system is to perform this role. An alternative to this approach would be to direct necessary car movements with ICC car service orders, with per diems being only a means of compensating the owning railroads for the use of their cars.

Car Service Orders

The ICC has the power to issue service orders for the movement of empty cars during periods of shortages. These orders usually have general applicability to all railroads and lay down certain guidelines to expedite car movement. These guidelines include (1) restricting free time at ports, (2) requiring carriers to handle traffic expeditiously and "place, pull and forward" cars within 24 hours, and (3) permiting substitution among types of cars (5). In some cases, the ICC has directed an order to a specific railroad to move a number of empty cars to another railroad. While these orders may be beneficial in a shortrun situation, they do little, if anything, to alleviate the longrun problem. Thus, under this system of car deployment, certain industries and areas may find it necessary to maintain careful watch on car supply and be continually prepared to petition the ICC for relief when shortages occur.

Demurrage

Demurrage is the fee paid per day by shippers and receivers for holding railcars for loading or unloading beyond certain established time limits. Demurrage was first assessed by American railroads about 1874, but it was not applied universally at that time nor were charges uniform (14, p. 598). In 1908, a committee of the National Association of Railway Commissioners stressed the need for uniformity in demurrage rules and charges. 7/ A year later, the committee reported its recommended code of uniform demurrage rules and charges. The code was adopted by the association and endorsed in principle by the ICC.

In ICC's Annual Report to Congress for 1909, two benefits of uniform demurrage rules and charges were stressed: (1) an increase in car efficiency through the securing of more prompt loading and unloading by consignors and consignees, and (2) assurance against discriminatory charges via rigid adherence to a uniform national practice applicable to interstate and intrastate shipments alike (14, p. 600).

Various court cases have resulted from the enforcement of demurrage rules.

7/ Interstate Commerce Commission. (Unpublished material.)

Much of the litigation has been on the proper role of demurrage. Supreme Court Justice Louis D. Brandeis characterized demurrage charges as follows in Turner Lumber Co. vs C. M. and St. P. Ry.: "All demurrage charges have a double purpose. One is to secure compensation for the use of the car and of the track which it occupies. The other is to promote car efficiency by providing a deterrent against undue detention."

During emergency shortages of freight cars, the ICC has issued service orders imposing higher demurrage charges. At times, these orders have applied to specific types of cars; at other times, they have applied to all cars subject to demurrage. Shortages resulting from the business expansion of the 1960's and the decline in available cars prompted the issuance of Service Orders No. 979 and No. 1023 providing for increased demurrage charges (table 15).

Table 15.--Demurrage charges and charges resulting from ICC Service Orders, selected periods, 1966-69

Day after placement[1/]	Demurrage charge in effect per day			
	Prior to 5/1/66	Service Order No. 979, effective 5/1/66-6/30/67	7/1/67-4/30/69	Service Order No. 1023, effective 5/1/69-9/1/69
	Dollars			
First 2 days	Free	Free	Free	Free
Next 4 days	5.00	7.50	5.00	5.00
Next 4 days	10.00	15.00	10.00	25.00
All additional days	15.00	15.00	15.00	50.00

1/ The description here is nominal. Tariffs specify precisely how the count of days after placement is to be made, and the rules regarding "averaging." Perhaps as much as 80 percent of all traffic is subject to "averaging agreement" under which debits and credits for demurrage accounts are accumulated (10).

Source: (3, p. 30).

FUTURE CAR SUPPLY

The shortage of general purpose boxcars will probably continue for some time. Service orders specifically directing the movement of cars as well as those pertaining to demurrage and other legal measures will probably be necessary for several years. However, any of several factors discussed below may alter the situation.

Competition from other modes of transportation may help to reduce the demand for railcars. Data from the U.S. Army Corps of Engineers indicate that barges moved considerable tonnage of grain in recent years--12 million tons of feed grains in 1968, compared with about 4 million tons in 1961. Barges also

move large tonnages of other commodities such as wheat and soybeans.

The incentive per diem order should have a positive effect on car supply. Railroads will be encouraged to return empty cars to the owning railroad. The provision earmarking funds for purchase of new cars or rebuilding of old cars should add some general purpose boxcars to the fleet each year.

New techniques and innovations such as the "mini train"[8/] may be expected to improve railroad operations. More centralized traffic control and computerized systems to keep track of cars should also increase efficiency.

As railroad equipment becomes more specialized, general purpose boxcars will tend to decline in importance. Eventually they will probably be used primarily to provide reserve capacity.

None of these "expected" effects are adequate to suggest that all shippers' demands for cars will be met promptly in the future. Although the railroads' internal pricing system of car rentals may be manipulated to obtain a more equitable distribution of cars and to change the level of utilization, other factors--charges for railcar service, the seasonal nature of many shipments, and the availability of other modes of transportation--determine the total quantity of cars demanded. Since the number of cars demanded at a particular time may exceed the number of cars in service, improved pricing policies can only alleviate the problem, not eliminate it.

8/ A system introduced by the Illinois Central Railroad employing small trains, usually five cars, in grain-gathering operations.

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